

## **Tinnitus and Noise Sensitivity Among Adolescents – A Self-Reported Questionnaire Survey**

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### **Introduction**

Tinnitus can be defined as a sound in the ears and/or head without an external source (cited in Alam, Katarkar, Shah, Jalvi, Jain & Shah, 2012). Tinnitus can be an annoying and sometimes a frightening experience. It changes the lifestyle of the individual due to its intrusive nature, irrespective of age, gender, race and socioeconomic status. The causes of tinnitus may vary. Exposure to noise is the most common cause of tinnitus but it can also be caused by drugs, diseases and stress and head injuries. Tinnitus is common among people around the age of 40, but it is becoming increasingly prevalent among the younger generation, as well, because of increased daily noise levels which are caused due to the unrestrained usage of MP3s, iPods and other personal stereos. Frequent leisure noise exposure louder than 90 dB holds a significantly higher risk for the development of hearing problems. The people suffering from tinnitus will be at high risk of developing serious psychological disturbances or serious psychological distress. Whether or not individuals experience or are annoyed by tinnitus seems to be associated with experienced stress in their life situation (Erlandsson, 1990) and with the experience of other people's attitudes towards tinnitus (Erlandsson, Hallberg and Axelsson, 1992).

According to Stansfeld (1992), sensitivity to sound can be understood from two different angles. First of all, noise and sound are important for people who are sensitive to sound and these individuals they tend to pay attention to sounds and differentiate sounds more often than others do. When compared with people who are not sensitive to sound, the individuals who are sensitive perceive sounds as more threatening and experience lesser control over the situation. Secondly, people sensitive to noise react more heavily to unexpected sounds than the non-sensitive, which implies that it takes longer for them to habituate to a sound and moreover they experience more threats from sounds and have a general tendency to be more irritated, irrespective of the sound exposure. Stansfeld (1992) conclude that these set of conditions can explain the relationship between noise sensitivity and mental health.

Young people exposed to loud noise ( $\geq 97$  dB NIL) reports tinnitus three times more likely compared to those exposed to low-level noise (Davis, Lovell, Smith & Ferguson, 1998) . In the young population, the exposure to loud noise increases with age i.e. they willingly expose themselves to high levels of noise intensity because of their habit of listening to music in nightclubs, parties, gyms and mainly using earphones of iPods, MP3, MP4, cell phones, among others, without worrying about the time and intensity of this exposure. The experience of temporary tinnitus and hearing loss after activities with loud music is rather common among young women and men. The most important reason for the development of noise-induced hearing loss in younger adults is the noise during leisure time. The effects of constantly being exposed to loud levels of noise can manifest themselves later in life (Widen & Erlandsson, 2004).

According to a study in Sweden by Jokitulppo, Bjork and Akaan- Pentilla in 1997 on noise exposure among teenagers, there were significant differences between the sexes in the choice of leisure time activities. Activities with the most exposure to severe noise like playing in a rock band, take part in motor sports, shooting etc. were preferred by boys. However, some studies have been undertaken regarding exposure to loud noise and the prevalence of noise sensitivity and tinnitus among adolescents, no studies have focused on adolescents and the use of hearing protection in noisy activities. This area of study is of special interest today, as the awareness of the damaging effects of loud levels of noise during leisure time activities might have increased in recent years among adolescents.

### **Need for the Study**

There are several studies that deal with tinnitus and noise sensitivity among young adults, but there are only limited Indian studies which report these findings. In India, there does not appear to be many studies focused specifically on the young adult's experience with tinnitus that caused due to noise exposure. The present study will provide information that tinnitus as the major cause that leads to hearing loss due to prolonged noise exposure.

### **Aim**

The aim of the present study is to identify the occurrence of tinnitus and noise sensitivity among young people and to describe their habits regarding noise exposure and the use of hearing protection.

### **Review of Literature**

Tinnitus is considered as the perception of abnormal noise in one or both ears or in the head. It is an increasing health concern across all strata of the general population. The effects of tinnitus on quality of life are highly individualized, and personality characteristics may

predispose a person to experience tinnitus as a “distressing” symptom (Henry & Wilson, 2000). As a consequence of environmental factors such as exposure to loud noise, tinnitus is becoming prevalent among the young population. Arguably, exposure to loud noise may increase the risk of physiological damage to the auditory organ which, in turn, can lead to tinnitus (cited in Kroener-Herwig, Biesinger, Gerhards, Goebel, Greimel & Hiller, 2000). Although tinnitus can be a symptom of an illness that can be managed and treated, for example, acoustic neuroma or otosclerosis, the most common underlying cause of tinnitus is associated with relatively small changes in the cochlea (Vernon and Moller, 1995).

According to Davis, et al. (1998), young people who reported tinnitus differed, depending on the level of social noise exposure, their pure tone thresholds, speech in noise tests results, otoacoustic emissions and regarding problems concerning hearing. The effects of social noise exposure on hearing in adolescents have also been investigated by Meyer-Bisch (1996). Significant differences regarding auditory complaints e.g. the presence of tinnitus and hearing fatigue were found between those who regularly attended discotheques when compared to control groups. Damage to hearing was found in who made frequent use of personal stereos players or who regularly went to concerts, although this damage, however, did not appear among those who frequently went to discotheques. In the past 20 years, the prevalence of tinnitus in young adults has increased from 6.7% to 18.8% (Sliwinska-Kowalska & Davis, 2012). However, recent studies have shown that approximately 18% of young adults between the ages of 18 and 25 also experience tinnitus (Degeest, Corthals, Vinck & Keppler, 2014).

Gilles, Van Hal, De Ridder, Wouters & Van de Heying (2013) conducted a study on high school students aged 14 to 18 and the aim of the study was to get the prevalence data regarding permanent noise-induced tinnitus as well as temporary tinnitus following noise exposure. The ‘Youth Attitudes to Noise Scale’ and the ‘Beliefs About Hearing Protection and Hearing Loss’ were used in order to assess the attitudes and beliefs towards noise and hearing protection respectively. The results of this study indicated that the prevalence of temporary noise-induced tinnitus and permanent tinnitus in high school students were 74.9% and 18.3%. An increasing prevalence of temporary tinnitus with respect to age was present. Most subjects had a ‘neutral attitude’ towards loud music and the use of hearing protection was minimal (4.7%).

Studies have found that infections, illness, stress and exposure to noise seem to be some of the causes of tinnitus in young adults (Raj Bartnik, Skarzynski, Pilka, Fabijanska, & Borawska, 2008) These causes also affect older adults as well (Gopinath, McMohan, Rohtchina, Karpa, & Mitchell, 2010). However, chronic noise exposure has been reported as the main cause of tinnitus in young adults who expose themselves to extremely loud noise which can be in the form of personal-listening devices, recreational activities or attending nightclubs (Salvago,

Ballacchino, Agrifoglio, Ferrara, Mucia & Sireci 2012). This puts them at risk of acquiring tinnitus as well as hearing loss.

Figueiredo, Azevedo, Oliveira, Amorim, Rios & Baptista (2011) conducted a study to analyze the incidence of tinnitus in mp3 player users and non-users. 100 subjects aged from 15 to 30 years were enrolled, 54 of them were regular mp3 player users and 46 were not. Patients with continuous tinnitus for at least 6 months completed the Tinnitus Handicap Inventory (THI) and were tested with high frequency audiometry and transient evoked otoacoustic emissions (TEOAE). The results revealed that the incidence of tinnitus in non-users was about 8 %; in mp3 player users, it was about 28 %, a statistically significant difference. Hearing thresholds at 8 kHz were higher in tinnitus patients who used mp3 portable players. TAOE were also reduced at 2 kHz in the user's group.

Rawool & Colligon-Wayne (2008) conducted a study in order to evaluate auditory life styles and beliefs of college students with reference to exposure to loud sounds. A survey was administered to 238 students in the USA. Results indicate that 44% of the students use noisy equipment without ear protection and 29% (69/238) of the students work in noisy environments. Of the 69 subjects who worked in noisy surroundings, only ten reported wearing hearing protection devices although 50 (72.46%) reported tinnitus.

Holgers & Pettersson (2005) presented a study to evaluate the factors of importance for the experience of temporary threshold shift (TTS), noise-induced tinnitus (NIT), spontaneous tinnitus (ST) in school children. A total of 671 students aged 13-16 years old were included in the study and were asked to fill in a questionnaire containing items concerning TTS, NIT, ST, hearing loss. The risk for TTS was nine times higher in students who reported having a verified hearing loss, the risk for NIT was approximately four times higher in the group who visited musical shows 6-12 times per year, a threefold increase in the risk for ST in the group that sometimes experienced TTS, and a tenfold increase in risk for spontaneous tinnitus in those who reported having a verified hearing loss.

Holmes, Widen, Erlandsson, Carver & White (2007) conducted a study to estimate the prevalence of hearing loss, tinnitus, and temporary threshold shift in community college students. Young adults (age 18-27) completed questionnaires. Results suggest that 6% of respondents reported perceived hearing loss, and 13.5% reported prolonged tinnitus. In general, participants had neutral attitudes toward the noise. Over 20 percent of participants reported ear pain, tinnitus, and/or TTS after noise exposure at least sometimes. Coincidentally, few subjects reported consistent use of hearing protection.

In India, there is only limited research focusing specifically on the experience of tinnitus and noise sensitivity among young adults. Hence the present study is aimed to investigate this area.

## **Method**

### **Subjects**

A total number of 540 students including both males and females between the age range of 13-18 studying in 8th grade to 12th grade and undergraduate students were selected for the study (Based on the questionnaire distributed and returned). Males (45) and Females (45) included a total of 90 subjects in each age of 13-18. The questionnaires were distributed to students of the secondary school, higher secondary school and also to under-graduate students of Kasaragod and Pathanamthita districts of Kerala from the urban area. The participants were instructed about the study and were provided with a questionnaire. The students who had hearing loss and any other metabolic and neurologic problems were excluded from the study. All the Subjects were provided with the verbal information about the study. Ethical committee clearance was taken for the study and confidentiality and privacy of the participants was also maintained.

### **Material**

A set of 26 questions were selected for the preparation of the questionnaire. The questionnaire was prepared in English; the questions were selected from the Youth Attitude towards Noise Scale (YANS) (Olsen & Erlandsson 2004), Hearing Symptom Description (HSD) (Erlandsson & Olsen 2004) and from various other questionnaires which were available on internet. The new questionnaire thus prepared was then translated into Malayalam by a person proficient in English and Malayalam. The questionnaire was then verified and validated by 5 experienced audiologists. The questionnaire contained 2 subsections. The first section was regarding tinnitus and the second section about the noise sensitivity. The questionnaire thus prepared consisted of 26 questions in total i.e.6 questions related to tinnitus and 20 questions regarding noise sensitivity.

### **Procedure**

The questionnaire was distributed among the students of the class 8<sup>th</sup> to 1<sup>st</sup>-year bachelor degree within the age range of 13 to 18. For obtaining the basic information the students were asked to fill their name, age and gender. The participants were told that the remarks for each question should be completely based on their personal opinion. In the first section which included questions regarding tinnitus, subjects were asked to answer the questions in the form of “yes or no”/”often or very often” in order to confirm the presence of tinnitus and under the section regarding noise sensitivity the subjects were instructed to mark their opinion in a 4 point Likert scale, with a maximum score of ‘3’ and minimum score of ‘0’ for each item.

**3-** Strongly agree, **2-** slightly agree, **1-** slightly disagree, and **0-** strongly disagree

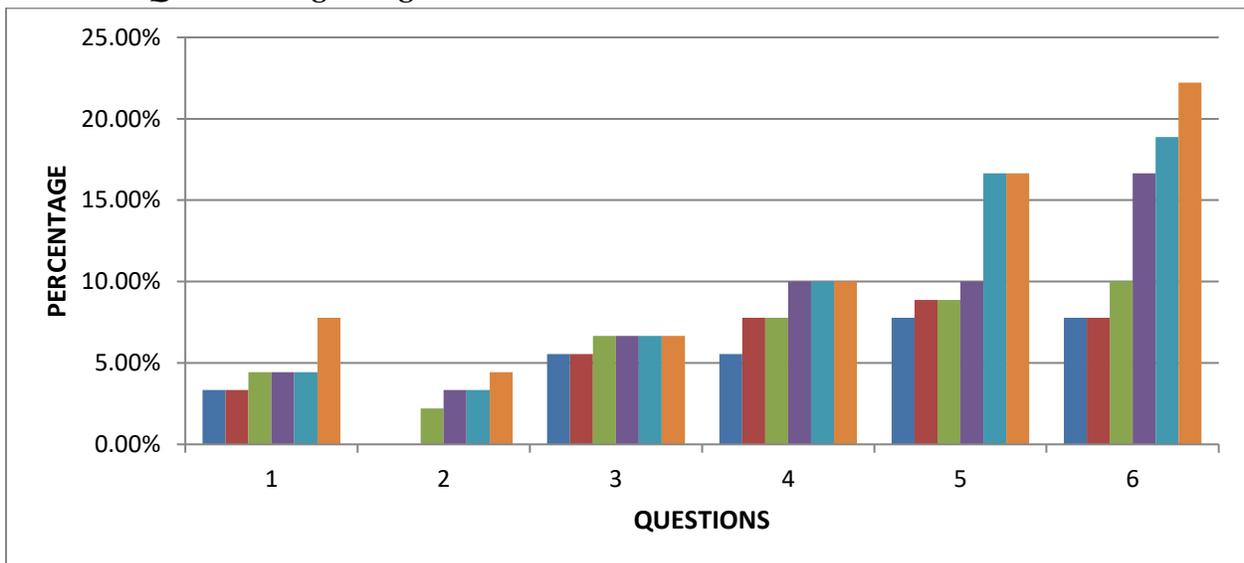
## Data Analysis

In the section of tinnitus, the percentage of students who answered “Yes”/ “Very often” to the questions are calculated for each age groups and for the section of noise sensitivity, the mean and standard deviation for all ages were found out separately in order to find out whether the subjects are more sensitive to noise.

## Results and Discussion

The aim of the present study was to identify the occurrence of tinnitus and noise sensitivity among young people and to describe their habits regarding noise exposure and the use of hearing protection. The performances of the subjects with respect to their attitude towards the tinnitus and noise sensitivity are explained in the following sections:

### Section-1: Questions regarding “tinnitus”



**Figure-1: Indicating the percentage of students responded “Yes”/”Very often” to the questions of section “tinnitus”**

The figure-1 shows the percentage of responses obtained for each question in the section containing questions regarding “tinnitus” of the questionnaire. The different colours indicate different ages (*Dark blue- 13years, Maroon- 14years, Green- 15years, Violet- 16years, Light Blue- 17years and Brown- 18years*). From the figure, it was observed that older adolescents responded “yes” to all the questions and “very often” to the second question as compared to younger students. The symptoms are more common among older than younger adolescents. This might imply an increase in tinnitus with age as a consequence of being exposed to noise for a longer period of time.

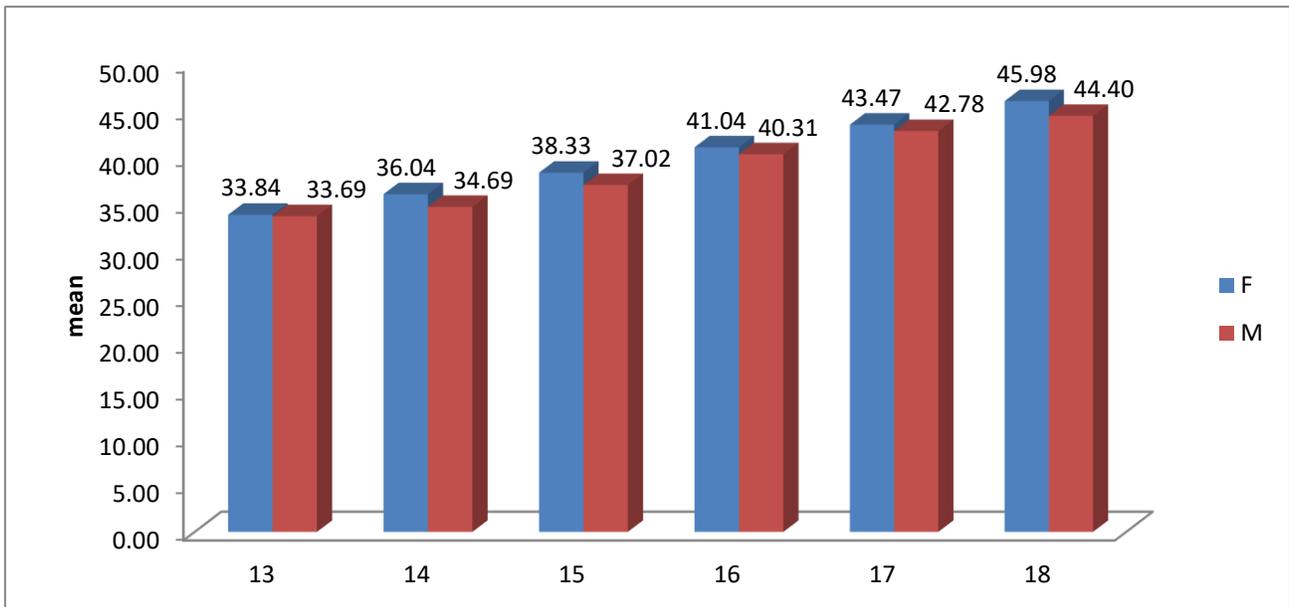
**Section-2: Questions regarding “noise sensitivity”**

Age	Sex	N	Mean	Std. Deviation	t value	p value	
13	F	45	33.84	6.769	.115	.909	NS
	M	45	33.69	6.097			
	Total	90	33.77	6.406			
14	F	45	36.04	6.109	.997	.321	NS
	M	45	34.69	6.772			
	Total	90	35.37	6.448			
15	F	45	38.33	4.651	1.297	.198	NS
	M	45	37.02	4.934			
	Total	90	37.68	4.813			
16	F	45	41.04	6.060	.619	.538	NS
	M	45	40.31	5.147			
	Total	90	40.68	5.603			
17	F	45	43.47	5.578	.603	.548	NS
	M	45	42.78	5.261			
	Total	90	43.12	5.403			
18	F	45	45.98	4.741	1.739	.086	NS
	M	45	44.40	3.816			
	Total	90	45.19	4.352			

**Table-1: Indicating the responses of individuals in the section “noise sensitivity”**

The table-1 shows the mean scores and p-value of males and females of different age groups in the section containing questions regarding “noise sensitivity” of the questionnaire. It

was observed that older individuals had increased mean scores compared to younger groups, indicating that as the age increases the noise sensitivity also increases. No statistical differences were found between the males and females of different age groups ( $p > 0.01$ ).



**Figure-2: Indicating the mean values of males and females in the section “noise sensitivity”**

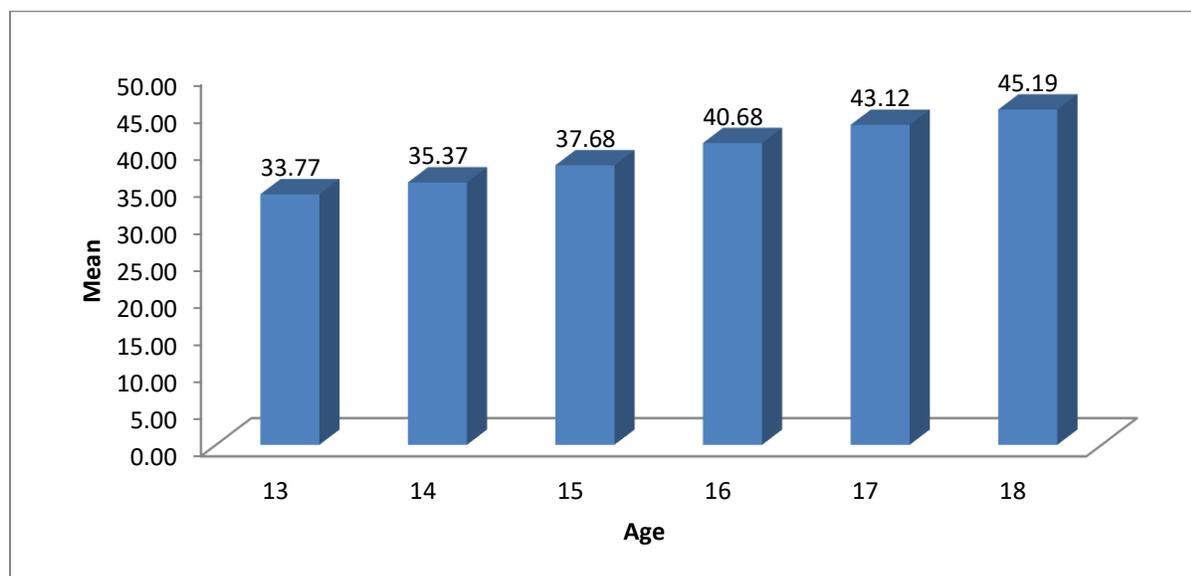
Figure-2 indicates the mean scores of males and females of different age for the section containing questions regarding “noise sensitivity” of the questionnaire. From the figure, it can be observed that the females are having a slight increase in scores than the males. This is because males typically tolerate a higher level of background noise and females are more worried prior to

Age	N	Mean	Std. Deviation	ANOVA	p value	
			n	A F		
13	90	33.77	6.406	58.230	.000	HS
14	90	35.37	6.448			
15	90	37.68	4.813			
16	90	40.68	5.603			
17	90	43.12	5.403			
18	90	45.19	4.352			

attending activities where loud noise exposure could be expected.

**Table-2: Indicating the mean scores and the p-value of total individuals of each age group.**

The results from table-2 show the mean and p-value of total individuals in each age group. The table indicates high scores for older individuals than younger ones. The results of ANOVA show that there is a significant difference between the age groups (p-value<0.01).



**Figure-3: Indicating the mean scores of total individuals of each age group.**

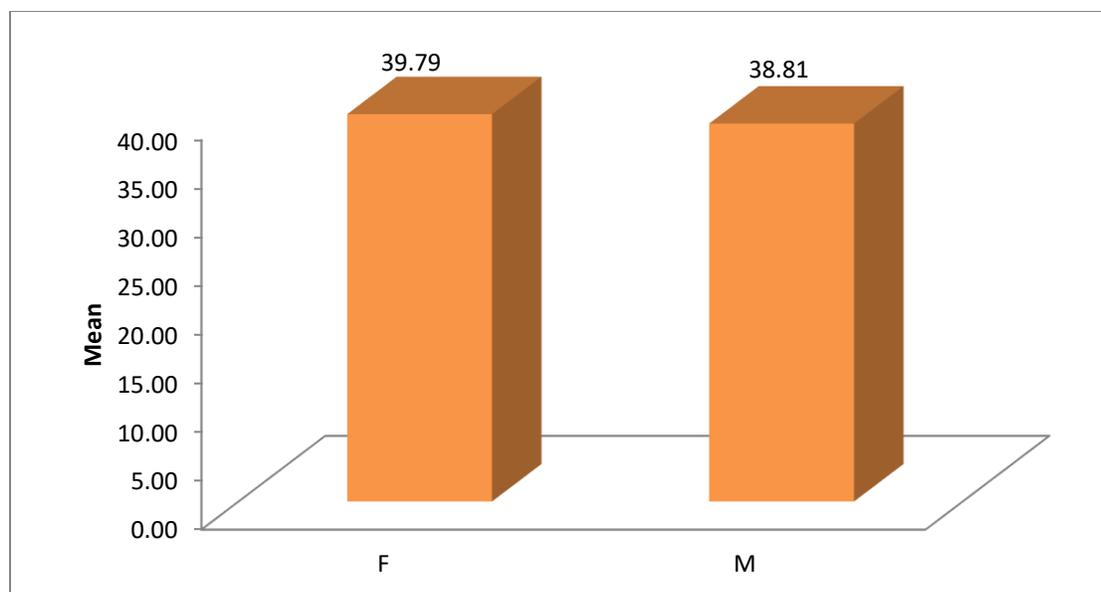
Figure 3: Indicates the mean values of all individuals in different age groups for the section of noise sensitivity. From the figure, it can be observed that older subjects had higher

Sex	N	Mean	Std. Deviation	t value	P	
F	270	39.79	7.032	1.642	.101	NS
M	270	38.81	6.694			
Total	540	39.30	6.876			

scores indicating noise sensitivity.

**Table-3: Indicating mean score and the p-value of male and female groups**

The results from the table-3 show the mean scores and the p-value of male and female groups. The table clearly depicts a slight increase in scores for females as compared to males. But no statistical differences were found between the male and female groups ( $p > 0.01$ ).



**Figure-4: Indicating the mean scores of male and female groups.**

Figure-4: shows the mean scores of male and female groups for the section of noise sensitivity. From the figure, it can be observed that females are having higher scores as compared to males indicating a slight increase in noise sensitivity.

### **Discussion**

Excessive noise exposure can result in transient, as well as chronic ear damage. In young adults, exposure from leisure activities is mainly a cause for concern. Among teenagers, the symptoms of tinnitus are increasing. This is mainly due to the overuse of their personal listening devices for a long period of time, as well as participating in louder noise activities. The cochlear hair cells can be temporarily or permanently damaged when exposed to very loud music or noises or sounds. It can also be overloaded due to leisure noise exposure.

Widen & Erlandsson (2004) stated that exposure to noise seems to increase with age during adolescence since older adolescents attend pop concerts and discotheques more frequently than their younger peers do. The present study is related to the tinnitus and noise sensitivity among adolescents. Results of the present study show that tinnitus reported being more common among older than younger adolescents. This is mainly because of the exposure to noise over a long period of time and this result shows an increase of tinnitus with age (Widen & Erlandsson, 2004).

According to Jokitulppo et al., (1997), the prevalence of tinnitus was more common among upper secondary school students (10.3%) than among secondary school students (6.8%). As compared with younger adolescents, older adolescents are engaged in more habits and

activities. Similar findings were obtained for the present study also. Earlier studies have found that the habits of the participants which lead to frequent exposure to loud sounds mainly change when they become older.

Several researchers (Gilles, Van Hal, De Ridder, Wouters & Van de Heying, 2013; Holmes, Widen, Erlandsson, Carver & White, 2007) have found that an increasing prevalence of temporary tinnitus with age was present compared to permanent tinnitus and ear pain, tinnitus, and/or temporary threshold shift was reported by 20% of the participants after noise exposure.

Results of the present study about noise sensitivity show that older adolescents have more problems compared to younger ones. The habits and activities related to sounds of older differ from younger adolescents. The findings of Widen and Erlandsson (2004) support the present study. According to their findings, older students reported the symptoms of noise sensitivity to a greater extent than younger students did. In the present study, it was found that females had a slight increase in the scores of noise sensitivity as compared to males. This may be because female adolescents are more worried prior to attending activities where loud noise exposure could be expected. Several researchers (Dehnert, Raab, Perez Alvarez, Steffens, Bolte, Fromme & Twardella, 2015) have found that a high proportion of adolescents aged 15-16 years are exposed to noise levels during leisure time bearing long-term risks of hearing loss. Williams & Carter (2017) reported that a direct correlation was found between tinnitus and life-time noise exposure.

### **Summary and Conclusion**

Tinnitus is characterized as one or more sounds perceived in one or in both ears, alternatively perceived as being located in the head, without any external source of sound (Hiller & Goebel, 1999). It may appear as a constant or continuous sound or it might be intermittent. This can be explained as ringing, hissing, whistling, buzzing, or clicking sound and it may vary in pitch from a low roar to a high squeal. Tinnitus is a common condition that can disrupt one person's life. Its causes may vary.

Due to the exposure to loud noise or sounds, the prevalence of tinnitus increases in adolescents 'or young adults. Young people are exposed to loud sounds, more than any other age group, especially during leisure time activities such as discotheques and also attend musical venues festivals and concerts where even higher music levels are obtained to which they are exposed for several consecutive hours. Therefore, this study was conducted to identify the occurrence of tinnitus and noise sensitivity among young people. The aim of the present study was to identify the occurrence of tinnitus and noise sensitivity among young people and to describe their habits regarding noise exposure and the use of hearing protection. The

performances of the subjects with respect to their attitude towards the tinnitus and noise sensitivity were studied.

From the results obtained in the current study, it was concluded that adolescents are exposed to loud noises or sounds, due to the exposure, the problems of tinnitus and noise sensitivity increases in these individuals. Among them, older adolescents experience more symptoms compared to younger ones. Most of them are unaware of the hearing protection because they do not recognize or notice the possible risks of loud exposure to music or sounds.

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